GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Control Systems Design, PG_00048426		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	February 2022	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Zdzisław Kowalczuk	
	Teachers	prof. dr hab. inż. Zdzisław Kowalczuk mgr inż. Karol Szymański	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	15.0	0.0	45
E-learning hours included: 0.0						

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	8.0	47.0	100

Subject objectives

The aim of the course is to master the knowledge about the design of computer control systems and the use of various types of mathematical models of objects, regulators and auxiliary processes in conrol design for continuous-time real-time objects.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] Knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum.	The student understands the principles of operation of automation components and systems, including theories and methods, and selected specific issues - specific to the automation training program	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K7_W06] Knows and understands, to an increased extent, the basic processes taking place in the life cycle of devices, facilities and technical systems.	Student knows the algorithms and numerical methods of adaptive control and adaptive design principles of control systems.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W08] Knows and understands, to an increased extent, the fundamental dilemmas of modern civilisation, the main development trends of scientific disciplines relevant to the field of education.	Student understands the fundamental dilemmas of modern civilization, development trends of scientific disciplines relevant to the field of education.	[SW1] Assessment of factual knowledge
[K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	The student is able to analyze the operation of automatic systems and systems and measure their parameters and examine technical characteristics, interpret the results obtained and draw conclusions	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>Design of digital control systems; Digital implementation of proper designs; Digital filters; Linear models of dynamic systems; State equations and signal flow graphs; Diagnosis and industrial facilities; Detection and isolation of instrumentation errors; Vehicle diagnostics systems; Example of the use of dynamic graphs in an automotive on-board diagnostic system; The effects of quantization in digital realizations: Typical structure of digital systems; The effects of parameters quantization; Reducing the length of registers; The effects of quantization noise; Discrete approximation of continuous-time systems; Direct method of invariant discretizing transformations; Other methods of direct discretizing transformations: convolution approximation, stochastic matching; Simple discretization methods of indirect transformations; Developed discretization methods of indirect transformations; Discretization in the state space; Methods of analysis of computer implementation of control systems; The effects of quantization in closed systems; Digital PID control algorithms; The structures of digital controllers; Analytical methods for the assessment of rounding errors; Simulation testing of closed-loop DDC digital control systems; Self-tuning control; Discretization and modeling of the control object; Recursive identification of non-stationary processes; Adaptive control - examples; Simulation study of self-tuning control systems; Summary - design guidelines.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Methods of mathematical modeling. Computer systems for discrete-time control. Digital control.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>project</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>exam</td><td>50.0%</td><td>60.0%</td></tr>
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<tr><td>Recommended reading</td><td>
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<tr><td>Basic literature</td><td>Z. Kowalczuk: Discrete-time models in control systems design. ZNPG, Gdańsk 1992.</td></tr>
<tr><td>Supplementary literature</td><td>B.C. Kuo: Automatic Control Systems. Prentice-Hall, Englewood Cliffs 1987.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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